OBSERVATIONS ON THE COLOUR INHERITANCE IN ROMULEA BULBOCODIOIDES.

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Introduction.

Colour variations occur in the flowers of many plants. Occasionally colour differences have been used to separate very similar plants into two species differing only in colour. Yet colour differences are often of a purely genetical nature and follow the ordinary Mendelian Laws of Inheritance. Where colouration is due to simple genetical factors, it is sometimes possible to observe this from ordinary field observations.

Very large numbers of the plant *Romulea bulbocodioides* occur on Rondebosch Common, Cape Town. This plant is of interest as its flowers occur in three colour varieties, having yellow, pale-yellow and white flowers. During the months of July and August, Romulea occurs in large masses, almost to the exclusion of other plants. This colony has been growing on the Common for much longer than thirty years.

As *R. bulbocodioides* is so well established and occurs in such great masses, it appears to be an eminently suitable plant on which to study the genetical behaviour of its colouring. Nothing is known of its genetical constitution and even its chromosome number is unknown. However, it probably possesses large numbers of chromosomes, as all the group of Iridaceae do. When studied, *R. bulbocodioides* showed only one mature open flower on each plant.

Methods.

The method employed to count the flowers was very simple. It consisted of counting all the flowers in a measured square meter. The flowers were divided into three types, yellow, pale and white flowers. At first sampling was entirely at random, but later special hybrid areas alone were investigated.

During the investigations, it was found that the pale flowers make an entire grade from yellow to white. This made sampling very difficult, so that it was eventually decided to distinguish only between yellow flowers and non-yellow flowers. These latter consisted of all the pale flowers and white flowers. The colours of the petals were measured in the usual way by comparison with Maerz and Paul's standard.(1) As it was only the top of the petals which showed this colour variation, only the tips of the petals were studied, not the entire petal.

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(1) Maerz, A. and Paul, M.R.: "A Dictionary of Colour," McGraw Hill Book Co., 1930.

EXPERIMENTAL.

The flowers were at first studied entirely at random, so that all possible combinations might be observed. The figures in Table I show a typical example of random sampling. All kind of combinations occur and there appears to be no relationship between these figures. Closer examination shows, that if the pale and the white flowers are counted together, about one-quarter of the counts approximate to the dihybrid ratio of 9 yellow : 7 other flowers. This is too high a percentage to be due to mere chance and so is worth investigating.

It is very difficult to distinguish between the various pale flowers and the white ones. This means that this is a source of error in the counts. These pale flowers occur in an entire grade from yellow to white but all shades do not occur in equal numbers. There are two pale types much commoner than the others; these are a pale yellow (Plate 9C, Maerz and Paul) and a cream-coloured type (Plate 9J).

The yellow colour is a lemon yellow (Plate 9D) and easy to distinguish from the other colours. Therefore, it was decided to distinguish between only two types of flower, the yellow ones and the non-yellow consisting of both pale and white flowers.

TABLE I.

Random Samples of Romulea bulbocodioides.
Number of Flowers per square metre.

Yellow.	Pale.	White.
*36	13	18
10	22	33
*17	10	8
9	5	17
18	15	15
33	13	26
35	18	22
*30	14	13
9	4	8
18	22	11
12	11	13

*Show the dihybrid ratio for the second generation, *i.e.* approximately 9 : 7.

Random sampling in the field yielded very little accurate information (Table I). Investigation showed that the flowers were not distributed homogenously. Patches of yellow flowers could be easily detected, as could patches of white ones. These areas were obviously regions in which true breeding types had separated out and were thus homozygous for colour. As the aim was to study the crossings of these two types, it was not desirable to include such areas in the samples taken.

When only areas which contain a good mixture of all colours were investigated, the figures obtained were very close to the dihybrid ratio for the second generation (Table II). It is remarkable how many do actually show this 9 : 7 ratio in the field. In all the areas examined, rather less than one-third did not show this ratio and many of these were situated very close to a true breeding area.

TABLE II.

Number of Flowers in One square metre in Hybrid Patches.

Yellow.	Pale and White.	Ratio.
36	31	$9 : 7\frac{7}{8}$
30	27	$9 : 8\frac{1}{5}$
15	13	$9 : 7\frac{1}{5}$
8	7	$9 : 7\frac{4}{5}$
* 9	9	$9 : 9$
*12	13	$9 : 9\frac{3}{4}$
15	13	$9 : 7\frac{4}{5}$
10	9	$9 : 8$
23	20	$9 : 7\frac{4}{5}$
*10	12	$9 : 10\frac{4}{5}$
17	15	$9 : 7\frac{9}{10}$
14	13	$9 : 8\frac{3}{10}$
31	22	$9 : 6\frac{2}{5}$
26	22	$9 : 7\frac{3}{5}$
*25	26	$9 : 9\frac{3}{10}$
23	20	$9 : 7\frac{4}{5}$
31	22	$9 : 6\frac{2}{5}$
15	13	$9 : 7\frac{4}{5}$
25	22	$9 : 7\frac{9}{10}$
17	15	$9 : 7\frac{9}{10}$

*Do not show dihybrid ratio.
Usually approximately one third of the samples do not show this ratio.

These results are unusual in that one would expect segregation of homozygous types to have occurred to a much larger extent in such an old and well-established colony. The only explanation can be that very intensive cross-pollination must occur in *R. bulbocodioides.*

CONCLUSIONS.

These investigations clearly show that yellow is the dominant colour and white the recessive in *R. bulbocodioides.* Dominance is not complete in heterozygous types, as these are pale-yellow or cream in colour. The other factor involved in this cross is almost certainly that for colour expression. This factor is also not completely dominant in the heterozygous state and this explains the occurrence of the various types of pale-yellow flowers. As the colours in these plants are so difficult to distinguish, this cannot be investigated in detail.

These plants appear to be well suited for genetical studies as colour is not the only characteristic that is inherited. The size of the plant also appears to be genetically determined. This factor was not investigated, although it was observed that both yellow and white plants were more frequently large in size than pale flowered ones.

SUMMARY.

Colour in *R. bulbocodioides* is genetically determined, the yellow and white types being homozygous, the pale-yellow types heterozygous. The plants were studied in the field and it was found that random sampling gave poor results, as this included homozygous colonies in the analysis. Only colonies showing a good mixture of both homo- and heterozygous types were investigated and these gave good results, as they show good crossing.

AFRIKAANS OPSOMMING.

Die kleur in die plantjie *Romulea bulbocodioides* is geneties vasgestel. Die geel en die wit blomme is die homozygotiese tipes. Die plantjies was in die veld studeer en dit is uitgevind dat die taal die plantjies van toevallig gevinde pleke, nie goeie resultate gee nie. Dit is omdat homozygotiese kolonies in die veld groei. Net goeie gemengte homo- en heterozygotiese kolonies moet studeer word om goeie resultate toe gee omdat hulle ware kleurkruising het.